

**Alendronate and Resistive Exercise Countermeasures Against Bed Rest-Induced Bone Loss:
Biochemical Markers of Bone and Calcium Metabolism.**

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Weightlessness-induced bone loss must be counteracted to ensure crew health during extended-duration space missions. Studies were conducted to assess two bone loss countermeasures in a ground-based model: horizontal bed rest. Following a 3-wk ambulatory adaptation period, male and female subjects (aged 21-56 y) completed a 17-wk bed rest protocol. Subjects were assigned to one of three treatments: alendronate (ALEN; 10 mg/d, n=6), resistive exercise (RE; 1.5 h/d, 6 d/wk, n=8), or control (CN; no countermeasure, n=8). Dietary intake was adjusted to maintain body weight. Endocrine and biochemical indices were measured in blood and urine using standard laboratory methods. All data reported are expressed as percent change from individual pre-bed-rest data. Serum calcium changed little during bed rest, and tended to decrease (4-8%) in ALEN subjects. In RE subjects, bone alkaline phosphatase and osteocalcin were increased >65 and >30%, respectively, during bed rest, while these were unchanged or decreased in ALEN and CN subjects. Urinary calcium was increased 50% in CN subjects, but was unchanged or decreased in both ALEN and RE groups. Urinary n-telopeptide excretion was increased 40-50% in CN and RE subjects, but decreased 20% in ALEN subjects. Pyridinium crosslink and deoxypyridinoline excretion were increased 20-50% during bed rest. These data suggest that RE countermeasures are effective at increasing markers of bone formation in an analog of weightlessness, while ALEN reduces markers of bone resorption. Counteracting the bone loss of space flight may require both pharmacologic and exercise countermeasures.